GUIDELINE

Retinopathy of Prematurity (ROP) Screening, Treatment and Ophthalmology Consultations

Scope (Staff):	Nursing and Medical Staff
Scope (Area):	NICU KEHM, NICU PCH, NETS WA

Child Safe Organisation Statement of Commitment

CAHS commits to being a child safe organisation by applying the National Principles for Child Safe Organisations. This is a commitment to a strong culture supported by robust policies and procedures to reduce the likelihood of harm to children and young people.

This document should be read in conjunction with this disclaimer

Contents

Aim

Retinopathy of Prematurity (ROP) is a disorder of the eye, which results in the abnormal development of retinal blood vessels in the preterm neonate. This guideline will outline the disease progression, screening guideline and treatment options.

Risk

Inadequate screening or delayed treatment can lead to vision impairment or blindness for the preterm infant.

Background

The most significant risk factor is extreme prematurity. Our local experience in Western Australia suggests that those born less than 31weeks gestation or less than 1250g birth weight are thought to be the most at risk.

The retina in the eye starts to develop at 16 weeks gestation, when the blood vessels of the retina begin to form at the optic nerve. The blood vessels and retina gradually grow outwards towards the anterior edge of the developing retina, supplying oxygen and nutrients. During the last 12 weeks of pregnancy the eye develops rapidly. When an infant is born full term, the retina and its blood vessel growth are mostly complete. When an infant is born prematurely, the blood vessels have not reached the anterior edge of the retina. The anterior periphery of the retina may not get enough oxygen and nutrients.

It is believed that the avascular anterior periphery then sends out signals (by various mediators, such as Vascular Endothelial Growth Factor (VEGF)) to encourage more blood vessels to form. New blood vessels begin to grow. These new blood vessels are fragile and weak and can bleed leading to retinal scarring. If the scarring shrinks, it can pull on the retina, causing it to detach. Retinal detachment is the main cause of visual impairment and blindness in premature neonates.

Definition - International Classification of ROP (ICROP 3)

There are five stages of ROP:

Stage 1: Demarcation Line. This is a thin but definite structure that separates the avascular retina anteriorly from the vascularised retina posteriorly.

Stage 2: Ridge. It arises in the region of the demarcation line, has height and width, and extends above the plane of the retina.

Stage 3: Extraretinal Fibrovascular Proliferation (or neovascularisation) extends from the ridge into the vitreous. Seemingly flat appearing extraretinal neovascularization can occur in eyes with Zone 1 or posterior Zone II disease, in the absence of an obvious ridge or demarcation line, and is also considered stage 3 disease.

Stage 4: Partial Retinal Detachment.

: Stage 4A – Partial retinal detachment that does not involve the fovea.

: Stage 4B – Partial retinal detachment that involves the fovea.

Stage 5: Total Retinal Detachment.

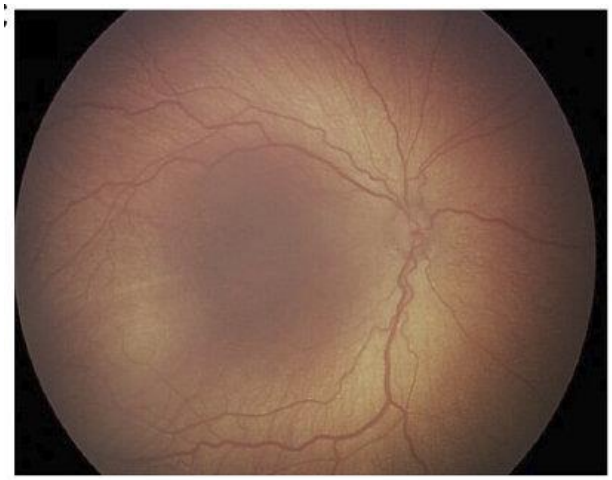
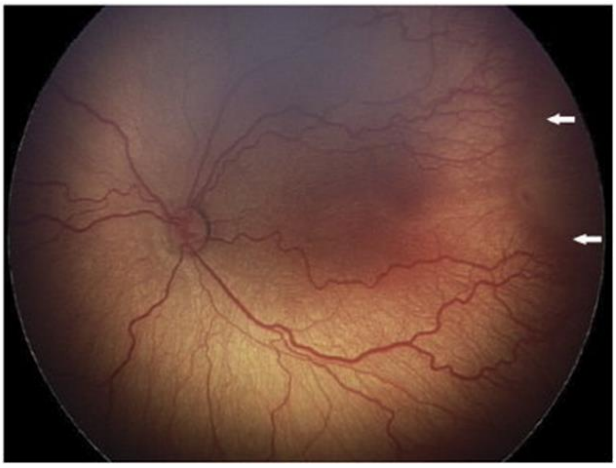
: Stage 5A – The optic disc is visible by ophthalmoscopy

: Stage 5B – The optic disc is not visible secondary to retrolental fibrovascular tissue or closed-funnel detachment

: Stage 5C – Findings of stage 5B, plus anterior segment abnormalities (e.g., anterior lens displacement, marked anterior chamber shallowing, iridocapsular adhesions, capsule-endothelial adhesion with central corneal opacification, or a combination thereof, suggesting a closed-funnel configuration descriptors of funnel configuration.

Plus Disease: Refers to the increased venous dilatation and arteriolar tortuosity of the posterior retinal vessels. It is determined from vessels within Zone 1.

Pre Plus: represents a continuous spectrum of retinal vascular changes, when there is early vascular changes, but not severe enough to be called 'plus'.

Pre- Plus	Mild Plus The white arrows represent a notch
	

Vascular engorgement of the iris, poor pupillart dilatation, and peripheral vascular engorgement with vitreous haze are signs of advanced disease but are not necessary for plus disease diagnosis.

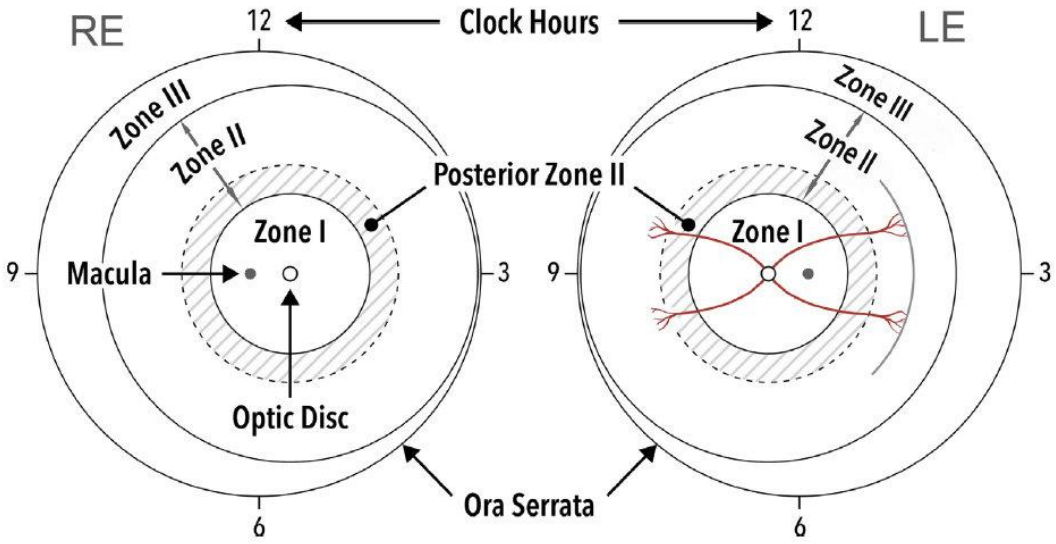
Other terminologies used in classification:

- Notch – in some cases, the demarcation line or ridge, instead of progressing in a circular fashion around the eye, it deviates in certain areas more posteriorly (see above). When staging ROP it is recorded by the most posterior zone if retinal vascularisation, that is where the notch is located with the noting 'secondary to notch'

- Incomplete vascularisation – accompanied but the zone of vascularization (eg incomplete vascularisation into Zone II) instead of 'no ROP' or 'immature retina'
- Regression – disease involution and resolution. Regression may be complete or incomplete, including persistence of retinal abnormalities.
- Reactivation – reoccurrence of acute phase features
- Long-Term Sequelae – Long term complications such as retinal detachment, persistent avascular retina, macular anomalies and retinal vascular changes and compilations.

Mild ROP (Stage 1 or 2) is more common and tends to resolve spontaneously. A small number will worsen and progress into higher stages. Sometimes ROP can worsen very rapidly and destroy vision (Aggressive Retinopathy of Prematurity [A-ROP]). A-ROP can reach threshold treatment, without going through stage 1 or stage 2 ROP, within days.

Infants with ROP are also at increased risk of developing other eye problems later in life such as retinal detachment, myopia, strabismus, and amblyopia. In many cases these problems can be treated or controlled.



Posterior Zone II is defined as a region of 2 disc diameters anteriorly peripheral to the zone I border (shaded grey in the above drawing).

Risk Factors for Developing ROP

Prematurity < 31 weeks gestation	Resuscitation at birth
Low birth weight < 1250 grams	Multiple infections
Anaemia and Blood transfusions	RDS and prolonged ventilation
High levels of oxygen given to preterm neonates used to be an important risk factor but with newer technologies and monitoring of oxygen levels, this risk has diminished.	

Screening Criteria

- All neonates born < 31 weeks gestation, regardless of weight.
- All neonates born < 1250 grams, regardless of gestation.
- Neonates will be screened at 4 weeks of age but no earlier than 31 weeks corrected gestational age.
- Neonates greater than 31 weeks gestation, born > 1250g, with additional medical concerns, will be screened at the discretion of the consultant and require a special consultation request.
- Screening of babies born after 31 weeks (<1250g BW) should be at GA +4 weeks or 36 weeks, whichever is EARLIER, that is, no later than 36 weeks CGA
- RetCam imaging will be ceased at 44 weeks corrected gestational age (CGA) or if baby is >4300g. These patients will then be screened by the Ophthalmology team.

	Age at First examination	
Gestation Age (GA) at Birth	**Corrected GA (in weeks)**	**Age (in weeks)**
22 weeks	31	9
23 weeks	31	8
24 weeks	31	7
25 weeks	31	6
26 weeks	31	5
27 weeks	31	4
28 weeks	32	4
29 weeks	33	4
30 weeks	34	4
31 weeks	35	4
Older gestation < 1250g	GA + 4 weeks	4

Adapted from American Academy of Pediatrics.

Transfer of Babies to Peripheral Hospital

- All neonates, which fit into the screening criteria, require a first review as an inpatient prior to transfer or discharge.
    - EXCEPTIONS – babies being transferred to Joondalup Health Campus, Perth Children's Hospital or Fiona Stanley Hospital where an ROP screening program is in place, or if care is being taken over by a private ophthalmologist at selected private hospitals.
- For peripheral hospitals without a ROP Screening Program in place, neonates can only be transferred if they are able to be seen in the Ophthalmology clinic at PCH on the date prescribed by the Ophthalmologist.
- Low risk neonates (> 30 weeks) can have their imaging session bought forward to allow for transfer or discharge. A priority outpatient appointment (OPA) will be made as per the Ophthalmologist request.

Discharge Planning

- Neonates within the screening criteria should be flagged with the ROP screening team if transfer or discharge is approaching.
- Neonates within the screening program, that have not yet been ordered a 3 month review, are to be imaged the week of discharge.
- Neonates considered 'safe' by the screening Ophthalmologist after the 38 week CGA review, can be ordered a 3-4 month OPA at PCH.
- If these 'safe' neonates remain as inpatients for > 4 weeks from the last date of imaging, the ophthalmologist is to be notified to see if repeat imaging is required prior to discharge.

RetCam Imaging

Medications (as per MR339)

Dilacaine	• Dilacaine Eye Drops are used to dilate the pupil and allow for examination of the fundus of the eye. • If the neonate shows signs of discomfort from ambient light in the nursery, a biliband may be applied for 3-4 hours or until the dilacaine has worn off.
Tetracaine	• Tetracaine Hydrochloride 0.5% Eye Drops (Amethocaine) is used to numb the eye and minimise discomfort prior to insertion of the eye speculum for ROP screening or eye examination.

ROP Screening Procedure

Refer to Appendix 1: ROP Screening at KEMH/PCH

- ROP Screening is conducted at the bedside by trained staff members.
- Digital images of the retina are taken and sent to the Ophthalmologist for review via Zeiss Forum.
- The procedure itself is short and with minimal discomfort to the neonate.
- If the images appear concerning, the Ophthalmologist is to be contacted immediately to urgently review the images.
- The automated report is sign and returned with follow-up instructions.
- The signed report is printed and filed in the patient's notes.
- The neonatal team is notified of any change or concern which is to be communicated with the parents.
- Any neonate not screened by the RetCam team, for any reason, is to have the MR339 completed with documentation stating the reason why screening was not attended.
- The Ophthalmologist is to be informed of any neonate not imaged and the reasons why. If it is clear that the neonate will not be suitable for imaging for some time, the ophthalmologist will need to see the neonate in person for binocular indirect ophthalmoscopy (BIO) screening.
- If an eye infection is present, a different speculum is used for each eye or a disposable speculum is used.
- Should the neonate's clinical status deteriorate at any time, the procedure is immediately stopped. Continuing or rescheduling will depend on the neonate's condition.
- Small red marks may be present on the neonate's eye lids from the speculum, this usually resolves within 5-10 minutes.
- Parents are welcome to be present for the procedure

Reprocessing of RetCam Lens

- Medical devices coming into contact with mucous membranes such as the conjunctiva of the eye must undergo High Level Disinfection (HLD) per AS/NZ 4187 Standards.
- To be conducted at the start of the day and after each screening session or if it is believed the lens has been contaminated.

Refer to Appendix 2 – Reprocessing of RetCam Lens Procedure

ROP Screening at Perth Children's Hospital (Ward 3B)

ROP screening is attended weekly at PCH by the RetCam Team. Nursing staff at 3B are informed the day before or morning off screening so dilating drops can be administered and parents informed. The process, criteria and considerations for screening are the same as KEMH.

Signed reports retrieved from J:drive by the 3B CNC or SDN and placed in the patient notes. Medical staff are informed of the results which are then discussed with the parents.

ROP Screening at Joondalup Health Campus

ROP Screening at JHC is attended weekly by the RetCam Team with the use of portable RetCam. Criteria and considerations for screening are the same as KEMH.

JHC is contacted early in the week to highlight the neonates that require ROP Screening. Discharge planning for these neonates is discussed. JCH is contacted the morning of screening with an approximate time of arrival so that dilating drops can be administered and parents informed.

Refer to Appendix 3: Screening with the Portable RetCam at Joondalup Health Campus

Treatment Options

Laser Therapy

The most effective treatment for ROP is laser therapy; this burns away the avascular periphery of the retina. This reduces the production of VEGF, which is the driving factor for abnormal growth of blood vessels, which in turn reduces the risk of tractional retinal detachment. Laser therapy is indicated in Type 1 ROP, as defined by the ET-ROP trial. In brief, Type 1 ROP refers to any ROP with Plus disease, and Stage 3, Zone I without Plus.

All babies requiring laser treatment will require ongoing follow up, and will require the Ophthalmologist to clear them for discharge or transfer to peripheral hospitals.

Laser therapy is conducted at Perth Children's Hospital. Neonates at KEMH are transferred to PCH 3B for treatment.

Pre-Operative Care

- Follow the general pre-operative care guidelines. Pre-operative bloods are not a routine requirement for this procedure. An IV is usually inserted on the ward prior to theatre.
- Fast for 3 hours (for EBM/BF) or 4 hours (for formula).
- Instil one drop of Dilacaine into each eye every 30 minutes for two hours prior to time of surgery to dilate the pupil.

Post-Operative Care

- Routine Post-Operative Care. Connect to a cardio-respiratory monitor on return from theatre. Hourly observations - TPR and BP hourly for 4 hours, then 4 hourly for 24 hours.
- Check MR 842 operation summary for specific post-operative orders.
- Feeds can be recommenced once the infant is awake as per neonatologist orders.
- Commence eye drops approximately 4 hours post operatively. Chloramphenacol 0.5% and Fluorometholone 1 mg/mL (FML) 1 drop to each eye 6 hourly, for 7 days as ordered.
- RetCam imaging can recommence one week post laser.
- Continued Ophthalmology follow-up as an outpatient will be required on discharge home.

VEGF Inhibitors

(Anti-VEGF) inhibit the production of VEGF. VEGF is produced by the avascular anterior peripheral retina in babies with ROP. VEGF is the driving factor for abnormal growth of blood vessels in the developing retina, and these abnormal blood vessels may cause tractional retinal detachment and blindness. VEGF inhibitor is used when the baby is too sick to have laser, or the disease is too posterior to allow laser to be done safely without risking damage to the macula or other significant visual structures. They are injected into the eye.

- Medication must be ordered from pharmacy with at least 24 hours' notice.
- Parental consent is required.
- The procedure is quick and conducted by an Ophthalmologist only. It involves injecting the medication into the vitreous space under aseptic conditions.
- All babies requiring treatment with VEGF inhibitors will require ongoing follow up as inpatients and post discharge.
- Chloramphenicol 0.5% is routinely prescribed for 5-7 days.

Avastin (Bevacizumab)

Avastin is a VEGF inhibitor. The BEAT-ROP trial suggested that the best indications for the use of Avastin is Zone I disease. There is a tendency of late recurrence of ROP after anit-VEGF use. These babies need to be monitored for a longer duration after the treatment.

Lucentis (Ranibizumab)

Lucentis contains the active substance Ranibizumab. It combines selectively to vascular endothelial growth factor Type A which is present in the retina and inhibits its action.

Refer to Appendix 4: VEGF Inhibitor Procedure

Ophthalmology Special Consultations

For any ophthalmic reviews not related to ROP, an e-referral must be completed.

- The on call Ophthalmology Registrar at PCH is to be phoned by the NICU medical staff, requesting a special consultation.
- If RetCam imaging is warranted – The Ophthalmology Registrar will inform the NICU medical team, who will then inform the RetCam team.

Related CAHS internal policies, procedures and guidelines
Neonatology Medication Protocols: • Chloramphenacol 0.5% • Dilacaine Eye Drops • Ranibizumab • Tetracaine Hydrochloride 0.5% Eye Drops (Amethocaine) Neonatology Guidelines: • Post-Operative Care • Pre-Operative Care

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10. http://retinopathyprematurity.com/rop/retcam-screening/
11. https://www.tristel.com/au/tristel-products/tristel-duo-oph
12. http://www.claritymsi.com/international/downloads/ShuttleBrochure_2013.pdf

This document can be made available in alternative formats on request.

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Appendix 1: RetCam Screening Procedure at KEMH/PCH

Steps	Additional Information
1. Patient ID checked and neonate is identified on the RetCam Software	
2. Edit Patient data to add a new note • Enter the name of the imager. • RS: (enter respiratory support). • C: (enter comments e.g.: first review, discharge planning). • Save note and begin video session.	The information provided will generate on the automated report at the completion of the screening session.
3. Sucrose is administered at least 2 minutes prior to imaging commencing, and neonate securely swaddled.	
4. Position the baby ready for imaging.	Neonates nursed in a perspex or wire cot are to be transferred to the RetCam trolley. Neonates may be imaged in incubators, on warmers or large open cots.
5. Tetracaine eye drops are administered 30 seconds prior to inserting the speculum.	A speculum is used to allow a clear view of the retina with the camera lens.
6. Poly Gel or Genteal Gel is administered for lubrication and to act as a bridging medium.	
7. The imaging session is videoed. Central, nasal, temporal, inferior and superior views are acquired.	If ROP is evident, care is taken to focus on the ridge or developing vessels.
8. The speculum is removed and placed inside the sterile packet, the gel is wiped away with sterile cotton balls and the RetCam lens is cleaned with 70% alcohol swab, between eyes.	
9. The procedure is then repeated on the left eye.	
10. Baby is returned to their cot or repositioned in the warmer/incubator.	
11. Still images are extracted from the video session.	
12. Images notes added.	Comments added are generated on the automated report.

Steps	Additional Information
13. Session synchronised.	Images are sent to Zeiss Forum for viewing and an automated report is generated (available in J:drive and emailed to the RetCam Team).
14. Documentation complete.	MR339, Neonatal Observation Chart and Progress notes.
15. Reprocessing of RetCam lens.	Surrounding equipment and surfaces to be wiped clean with Clinell wipes.

Appendix 2: Reprocessing of RetCam Lens

Steps	Additional Information
1. Apply two pumps of Tristel Duo OPH to Tristen Duo wipe and place lens tip on the foam for two minutes.	Minimum of two minutes is required for high level disinfection.
2. Remove foam residue with sterile water wipe.	Lens can be left to air dry or placed in sterile gauze packaging ready for use.
3. Clear documentation in the patient notes completed.	

Records must be kept in accordance with AS/NZS 4187 to ensure a system of traceability is in place to enable recall procedures to be followed in case of decontamination failure.

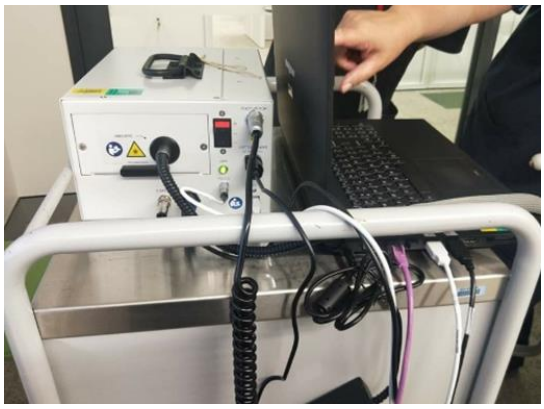
The following aspects must be documented:

- Date of processing
- Lens number
- Person responsible for the cleaning/disinfection process
- Batch numbers and expiry dates

Reprocessing of RetCam Lens for ROP Screening	
Date:	Time:
Prior to imaging: - 2 Pumps Tristel OPH ☐ - 2 min contact time ☐ - Sterile water wipe ☐	Batch number Tristel OPH & Expiry Date: _____ Batch number sterile wipe & Expiry Date: _____
Reprocessing performed by:	

Appendix 3: RetCam Screening at Joondalup Health Campus

Steps	Additional Information
1. Obtain a large medical trolley.	
2. Set up laptop and light source.	See Images below
3. Conduct Imaging session as per Appendix 1.	Neonates in cots are to be imaging on the resuscitation warmer unless otherwise specified by the coordinator.
4. Complete documentation.	Session to be documented in patient notes. Eye drops to be signed for on Medication Chart.
5. Portable RetCam to be packed down for transfer back to KEMH/PCH.	



Appendix 4: VEGF Inhibitor Treatment

Equipment

- Procedure trolley
- BD Microlance 3, 30G needle
- Alfonso eye speculum
- Caliper and rule (disposable)
- Forceps Suture Moorfeilds (disposable)
- Dressing pack
- Sterile gauze
- Sterile cotton tips
- Sterile cotton balls
- Normal Saline
- Half Strength Povodine - Iodine
- Chloramphenicol Eye drops AND Ointment
- Tetracaine (Amethocaine)
- Ranibizumab or Bevacizumab

A pre packed box with some of the equipment listed above is available in the RetCam Office (BG15). Check expiry date on the box before using.

A sterile field is required for this procedure.

Sterile gloves, gowns, theatre hat and surgical masks are required for the Ophthalmologists.

Procedure

Steps	Additional Information
1. Medication ordered through pharmacy 24hours before the procedure.	Exact order is required for pharmacy to dispense the medication in the correct amounts. (Ranibizumab or Bevacizumab)
2. Prepare sterile field by the bedside.	
3. Position baby supine, securely swaddle and provide sucrose.	
4. Bedside nurse or RetCam team member to securely hold the infant and tetracaine administered.	Infant must be still for the procedure. Actively sucking a dummy with sucrose is beneficial.
5. Half Strength Povodie-Iodine applied to ocular area.	To be cleaned with saline at completion of procedure.
6. Speculum inserted by Ophthalmologist and injection site measured.	
7. Medication injected by the Ophthalmologist into the vitreous space.	Cotton tip applied to injection site by Ophthalmologist if required.
8. Repeated with other eye.	
9. Chloramphenicol 1% Ointment applied to both eyes.	